

Aquatic insects, hereafter refereed to as macro-invertebrates, were sampled prior to, during and after the replacement of Burn Bridge and the Lower Twin Bridge. The first samples were collected in October 1985 and sampling continued through May 1999. Fish sampling also took place in 1991 and again in 1999 as part of a larger monitoring program.

### Macroinvertebrates

Macroinvertebrates were collected before during and after the phase 1 project, the replacement of the Burnt and Lower Twin bridges. In the fall of 1998, the macroinvertebrate lab that was conduction the identification and analysis of the samples was shut down and samples were sent to a new lab. Because both labs were interagency labs the type of analysis conducted and the level of detail differed. Some basic comparison can be made between labs but general trends are only discussed within labs for this report. Data collected in 1999 remains at the lab for analysis.

Table 1. The week in which macroinvertebrate samples were collected in the spring and fall on the Logan River.

year	Spring Sample	Fall Sample
1995	--	October 9
1996	May 5	October 28
1997	April 27	October 12
1998	April 19	October 11 <sup>(a)</sup>
1999	May 2	--

(a)

Sites 1 and 2 were discontinued because all work had been completed on the Burnt Bridge site.

The sample sites were located above and below the project areas.

Site 1 was located approximately 100 meters downstream from the Burnt Bridge (Figure 1 and 2).



Figure 2. Photo of Burnt Bridge. Sampling site is located just downstream and to the right of the photo location, Logan River, Cache County, Utah, fall 1997.



Figure 2. Sampling site is located directly behind and just downstream and to the right of the photo location, Logan River, Cache County, Utah, fall 1997.

Site 2 was located just below the mouth of Cottonwood Creek (Figures 3).



Figure 3. Looking upstream at macroinvertebrate sample site 2 just upstream from Logan Cave, Logan River, Cache County, Utah, fall 1997.



Figure 4. Looking across the stream at macroinvertebrate sample site 2 just upstream from Logan Cave, Logan River, Cache County, Utah, fall 1997.

Site 3 is located approximately 400 meters below the Lower Twin Bridge (Figures 5).





Figure 5. Macroinvertebrate sampling site number 3 located just below the Lower Twin Bridge looking upstream, Logan River, Cache Co. Utah, 1997.

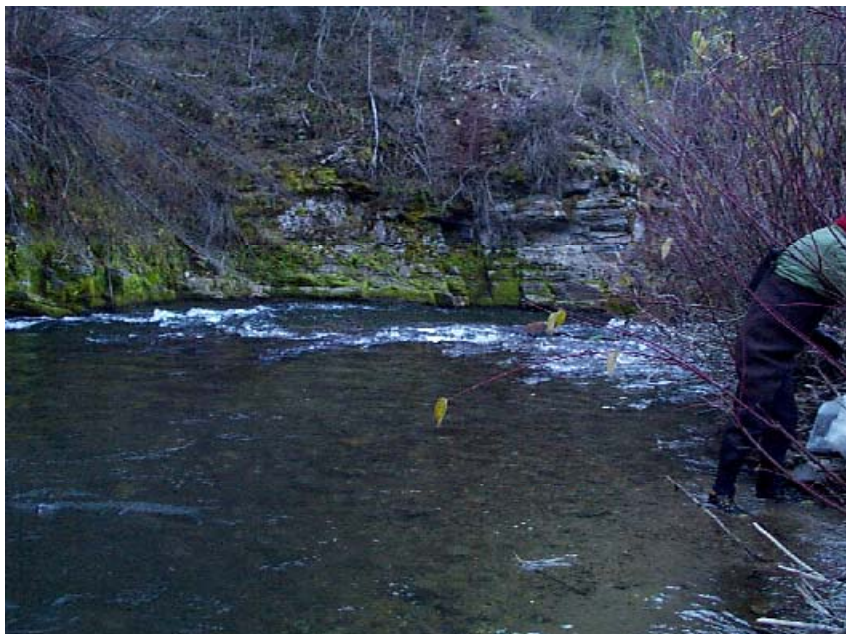


Figure 6. Macroinvertebrate site located just below Lower Twin Bridge, Logan River, Cache Co. Utah, 1997.

Site 4 is located approximately 10 meters above the mouth of Temple Fork. It was recognized that a better location for this site was below Temple Fork but no site had the necessary gravel for the site (Figures 7).



Figure 7. Looking downstream at macroinvertebrate sample site 4 just upstream from the mouth of Temple Fork, Logan River, Cache County, Utah, fall 1997. Note the truck on Highway 89.

Site 5 was located approximately 100 meters below the mouth of Ricks Spring (Figures 8).



Figure 8. Macroinvertebrate sample site 5 just downstream of Ricks Springs, Logan River, Cache County, Utah, fall 1997.

Site 6 was located approximately 50 meters above the mouth of



Ricks Spring(Figures 9).



Figure 9. Looking upstream from macroinvertebrate sample site 6 just upstream of Ricks Spring, Logan River, Cache County, Utah, fall 1997.

#### Macroinvertebrate Ananalysis

Five indexes were used to determine if the macroinvertebrate population had changed over the period of construction. These indexes are: (1) Diversity Index, (2) Standing Crop, (3) Number of Organism, (4) Number of Taxa, and (5) Biotic Condition.

Diversity Index: remained similar from preconstruction, 1995, during construction, 1996, and post construction 1997 at site one (Figure 10). A diversity index from 0 to 5 is considered poor, 6 to 10 is fair, 11 to 17 is good and 18 to 26 is excellent. The overall diversity appeared to drop across all six sites from 1995 to 1997. This appears to be related to factors other than the road construction that took place between sites one and two and between sites three and four. Site two, four, five and six should be viewed as control site with no work being done between sites five and six. A diversity index of 19 or above indicates a community in excellent condition (Mangum 1998).

Standing Crop: is measured in the mean grams per meter squared. A standing crop from 0 to 0.5 is considered poor, 0.6 to 1.5 is fair, 1.6 to 4.0 is good and 4.0 to 12.0 is excellent. The

overall standing crop for the six sites ranges varied greatly between sites and years (Figure 11). Again it appears that there

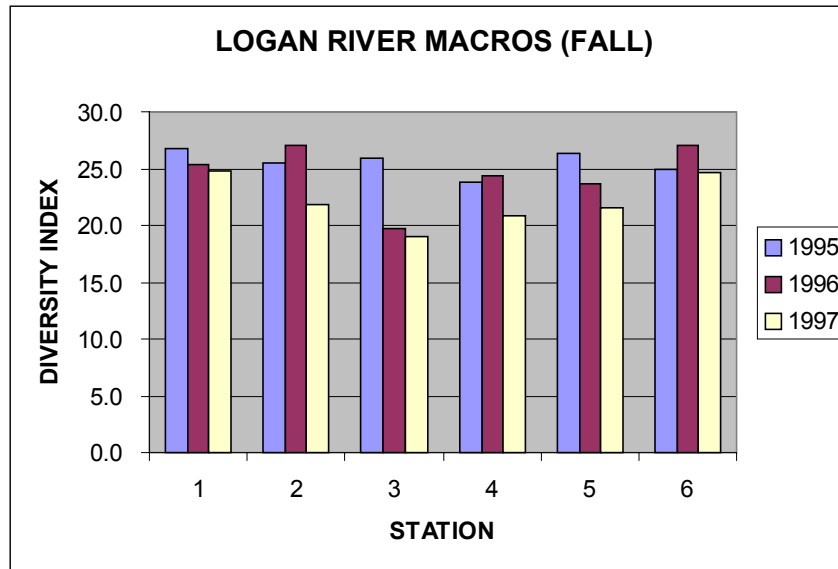


Figure 10. Diversity index for the six site on the Logan River over three years.

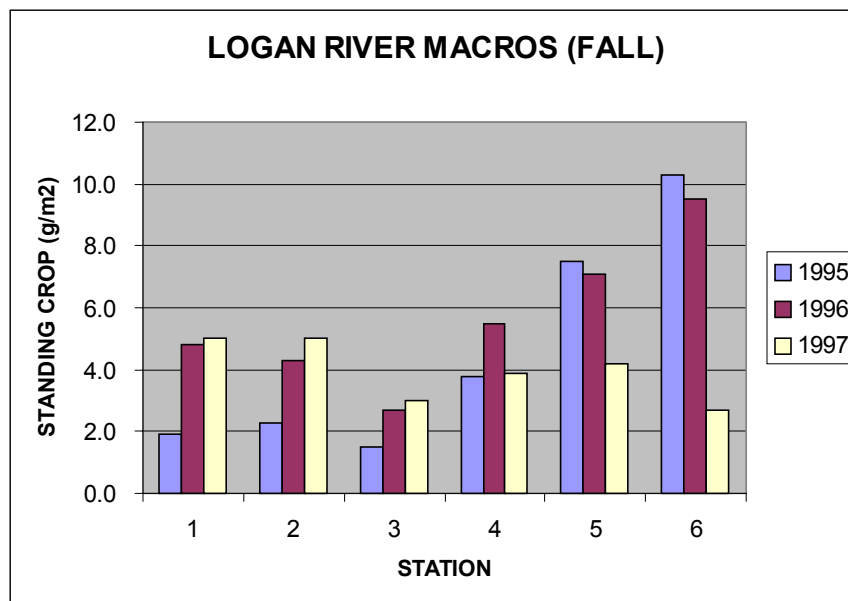


Figure 11. The standing crop for the six sampling site on the Logan River, Cache County, Utah.

Were no discernable construction effects from the project.

Number of Organism: varied between preconstruction, 1995, during construction, 1996, and post construction 1997 and between sites (Figure 12). This variation appears to be related to factors other than the road construction that took place between sites one and two and between sites three and four. Site two, four, five and six should be viewed as control site with no work being done between sites five and six.

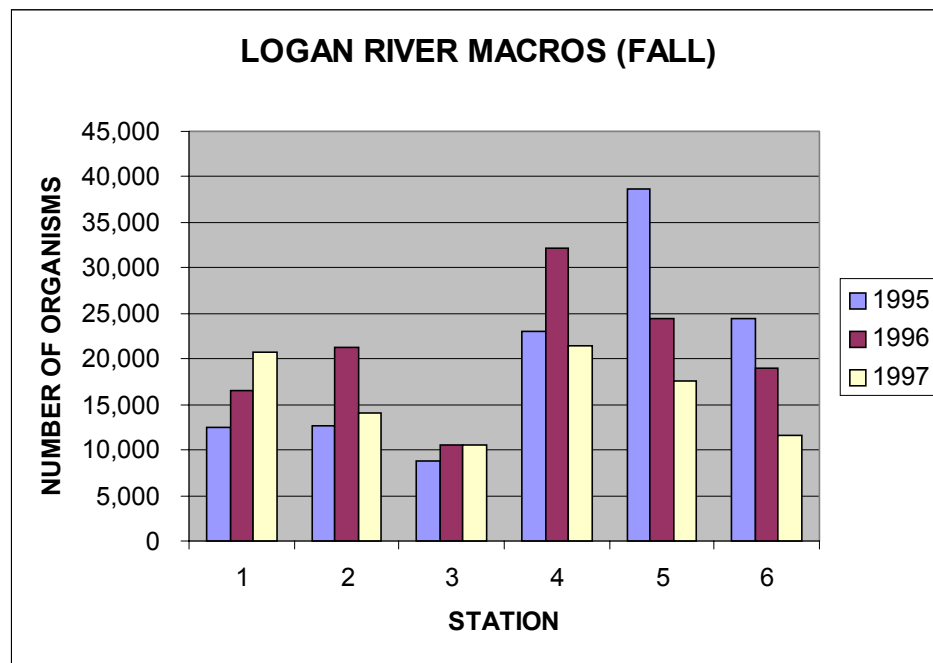


Figure 12. The number of organisms for the six sampling site on the Logan River, Cache County, Utah.

Number of Taxa: varied between preconstruction, 1995, during construction, 1996, and post construction 1997 and between sites (Figure 13). This variation appears to be related to factors other than the road construction that took place between sites one and two and between sites three and four. Site two, four, five and six should be viewed as control site with no work being done between sites five and six.



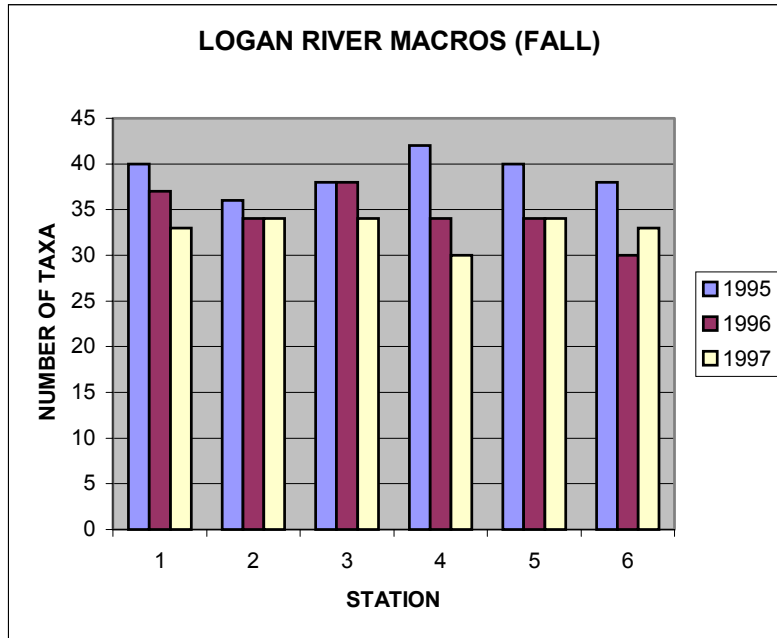


Figure 13. The number of taxa for the six sampling site on the Logan River, Cache County, Utah.

Biotic Condition: remained similar from preconstruction, 1995, during construction, 1996, and post construction 1997 at site one (Figure 14). A biotic condition from below 72 is considered poor, 72 to 79 is fair, 80 to 90 is good and above 90 is excellent. The overall biotic condition appeared to have remained stable or slightly increased across all six sites from 1995 to 1997. Variation in biotic condition appears to be related to factors other than the road construction that took place between sites one and two and between sites three and four. Site two, four, five and six should be viewed as control site with no work being done between sites five and six.

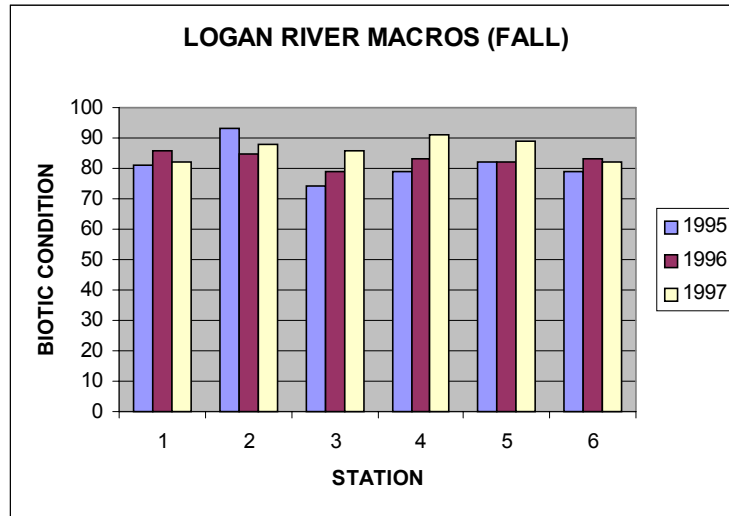


Figure 14. The biotic condition for the six sampling site on the Logan River, Cache County, Utah.

## Fish

Sampling sites for the fish collection were located in close proximity to some of the bridge replacement work.

### BURNT BRIDGE

Burnt Bridge is located approximately 0.9 miles upstream from section 06 of the 1999 Division of Wildlife Resource survey (Thompson et al 2000).

"The special fishing regulations enacted on the Logan River in 1990 were designed to improve the quality of trout fishing with particular on increasing the average length of the cutthroat trout. The regulations limit anglers fishing between Card Canyon Bridge and Red Banks Campground (and associated tributary streams) to three fish, which may include no more than two fish less than 12 inches (300 millimeters[mm] total length (TL), and no more than one fish greater than 18 inches (460 mm)TL. Only one of these fish may be a cutthroat trout, rainbow trout, or cutthroat trout-rainbow trout hybrid, and fishing tackle is restricted to artificial flies and lures only."(Thompson et al 2000).

#### Brown Trout

In 1999 16 age 1 and older brown trout were captured which equated to 83 "39brown trout per kilometer. This compares to 230 captured in 1991. No reason is given for this marked decrease.

#### Cutthroat Trout

In 1999, the cutthroat trout population was estimated at 304"1076 fish per stream km. In 1991 the cutthroat population was 305 fish per stream km. The authors view that the cutthroat was "almost identical".

#### Mountain Whitefish

In 1999 the whitefish population was estimated at 41"5 fish per stream kilometer. This compares to 93 whitefish per stream kilometer estimated in 1991. It is speculate that the difference in population estimates may have been due to drought conditions concentrating fish in this reach.

### **LOWER TWIN BRIDGE**

The Lower Twin Bridge survey reach was located just downstream of the Lower Twin Bridge. The survey section was approximately 100m below the survey reach in 1991. The section surveyed was adjusted because of the high flows found in the area on 25 August 1999 (Thompson et al 2000).

#### Brown Trout

In 1999, the population estimate for age 1 and older brown trout was 155"92 brown trout per kilometer. This compares to 236 captured in 1991.

#### Cutthroat Trout

In 1999, the cutthroat trout population was estimated at 86"16 fish per stream km. In 1991 the cutthroat population was 199 fish per stream km. The authors suggest that the cutthroat trout population had decreased slightly (Thompson 2000).

#### Mountain Whitefish

In 1999 the whitefish population was estimated at 54 fish per stream kilometer. This compares to 68 whitefish per stream kilometer estimated in 1991.

### **FORESTRY CAMP**

This site is downstream of the Forestry Camp Bridge and outside of the previous construction zone.

#### Brown Trout

In 1999, the population estimate for age 1 and older brown trout was 5"0 brown trout per kilometer. This compares to 12 captured in 1991.

#### Cutthroat Trout

In 1999, the cutthroat trout population was estimated at 1,361"95 fish per stream km. In 1991 the cutthroat population was 1,858

fish per stream km. The authors suggest that the cutthroat trout population had decreased slightly (Thompson 2000).

#### Mountain Whitefish

In 1999 the whitefish population was estimated at 25 fish per stream kilometer. This compares to 6 whitefish per stream kilometer estimated in 1991.

Similar population trends appear to have occurred in the survey section just adjacent the Red Banks Campground.

#### Overall:

**Brown Trout:** Overall brown trout populations have gone down in sections which may have been affected by the bridge work and in sections outside the reconstruction zone.

**Cutthroat Trout:** Cutthroat trout numbers have remained stable or decreased slightly throughout most of the Logan River over the past 8 years. There appears to be no correlation between the bridge replacement work and the population trends.

**Rainbow Trout:** Rainbow trout have mostly disappeared from the Burnt Bridge and Lower Twin Bridge sites. This is most likely due to a change in management emphasis and the halting of stocking.

**Brook Trout:** Brook trout appears to be moving downstream into the mainstem. It is believed that these fish are coming from the headwaters of Beaver Creek.

**Conclusion:** It does not appear, from the macroinvertebrate or fish surveys, that the bridge replacements have affect either the macroinvertebrate or fish communities. The require mitigation measures appear to be successful in reducing potential impacts to a level were they did not exist or were within the level of non-detectability.

**Mountain Whitefish:** Mountain whitefish have remained relatively stable over the past 8 years.



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